Creating COASTAL STEWARDSHIP through Science

Investigating Tule Elk

Pre-Visit Activities

How Can We Learn About the Return Of Tule Elk?

Students read *Tule Elk: The Return of a Species* to begin their understanding of elk and their place in the Point Reyes ecosystem. Two activity sheets can be used to assess reading comprehension and/or incorporate math into science. Understanding of the basic ecology of tule elk will be critical to the success of your students' field visit to Tomales Point.

Time required: 2 hours

Location: classroom or homework

Suggested group size: individual work or pairs

Subjects: science, history, math

Concepts covered: population dynamics, human ecology

Written by: Stephanie Stiller, Hill Middle School, Novato
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Last updated: 03/26/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand the importance and role of tule elk within Point Reyes National Seashore.
- Understand how natural and human activities relate to animal populations.
- Complete activity sheets based on comprehension of the tule elk newspaper.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade 5b - organisms and physical environment
5e - numbers and types of organisms an ecosystem can support depends on the resources available
7b - appropriate tools and technology to perform tests, collect and display data

Pre-Visit Lesson Plan

Creating Coastal Stewardship through Science

7c - develop qualitative statements about the relationships between variables
7e - recognize whether evidence is consistent with a proposed explanation

7th grade 3e - extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival
7a - select and use appropriate tools and technology to perform tests, collect and display data

8th grade 9b - evaluate the accuracy and reproducibility of data
9g - distinguish between linear and nonlinear relationships on a graph of data

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Think critically and logically to make the relationship between evidence and explanations; use mathematics in all aspects of scientific inquiry.
- Content Standard C - Populations and ecosystems.
- Content Standard F - Science and technology in society.

Materials

To be photocopied from this guide:

- **Pre- and Post-Evaluation** Activity Sheet
- *Tule Elk: The Return of a Species* Newspaper
- **The Return of a Species** Activity Sheet
- **Population Growth** Activity Sheet
- **Vocabulary** sheets located in Teacher's Preparation/Attachments

Vocabulary

birth control, contraception, extinct, intrusive, Public Law 94-389, relocation, sexually mature, subspecies, surpass, thrive, yearlings

Procedures

1. **Pre- and Post Evaluation**
   Distribute Pre- and Post-Evaluation activity sheets. Remind students this is not a graded test, but rather a measure of our success; each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute in the first post-visit lesson. Students can change their answers based on what they have learned.)

2. **Distribute Newspaper**
   Each student will need a copy of the newspaper, *Tule Elk: The Return of a Species*. Students can work in pairs or individually to complete activities.

3. **Reading Comprehension**
   Read the *Tule Elk: The Return of a Species* newspaper as a class or individually and discuss some of the major concepts.

4. **Activity Sheets**
   Give each student the appropriate activity sheets, vocabulary list, and instructions for completion.

5. **Conclusions**
   Review students' answers and relate these concepts to lessons already covered earlier in the year.

Extension Ideas

1. Using charts and graphs in the tule elk newspaper, have students speculate tule elk behaviors and activities that they may observe on their field trip.

2. Write an essay from the perspective of one of the tule elk living in the last known herd in 1874. Why are all of the tule elk disappearing? What do you need to survive? What would you say to Henry Miller? What would you say to the ranch worker that found you?

3. Provide students with Internet addresses listed in the Resources at the back of this guide. Encourage students to generate questions and seek answers.

Activity Master

Pre- and Post-Evaluation

Complete the Sentences
Choose the best word to complete the sentences below:

Behr Bill	endemic	immunocontraception	6 to 10
antlers	horns	sterilization	extinct

1. The ***Behr Bill*** gave tule elk official federal protection.
2. Occurring nowhere else, the tule subspecies of elk are ***endemic*** to California.
3. Scientific approach to managing the elk involves continuation of research, relocation, and ***immunocontraception***.
4. A female tule elk is likely to have ***6 to 10*** calves in her lifetime.
5. Male elk have ***antlers***, made of bone, which are shed and regrown annually.

You Be the Planner
Indicate which category the following management actions would fall under: research, relocation, or immunocontraception.

relocation Seventy elk moved to Limantour
immuno. Form of contraception
research Explore methods to manage elk population
immuno. Produce antibodies that block sperm from attaching to ovum
research Monitor environmental availability of food and water, predators, diseases, reproduction, and habitat
relocation Establish new herds
research Study tule elk ecology and population
immuno. Administered in a dart

Elk Facts: True or False
True Calves are born after 8.5 months.gestation.
True Average life span of wild elk is 12 years.
False Tule elk at Point Reyes National Seashore are threatened by many predators, including the grizzly bear.
False Both female and male tule elk have horns.

National Park System
List at least three units of the National Park System:
Point Reyes National Seashore, Golden Gate National Recreation Area, Muir Woods National Monument, John Muir National Historical Site, Yosemite National Park, Grand Canyon National Park, Washita National Battlefield

Stewardship
What can you do to support preservation of the elk population?
List ideas on the back of this paper.

Name _____ **Date** _____

Pre- and Post- Evaluation

Activity Sheet

Complete the Sentences
Choose the best word to complete the sentences below:

Behr Bill	endemic	immunocontraception	6 to 10
antlers	horns	sterilization	extinct

1. The _____ gave tule elk official federal protection.
2. Occurring nowhere else, the tule subspecies of elk are _____ to California.
3. Scientific approach to managing the elk involves continuation of research, relocation, and _____.
4. A female tule elk is likely to have _____ calves in her lifetime.
5. Male elk have _____ made of bone,which are shed and regrown annually.

You Be the Planner
Indicate which category the following management actions would fall under: research, relocation, or immunocontraception.

_____ Seventy elk moved to Limantour
_____ Form of contraception
_____ Explore methods to manage elk population
_____ Produce antibodies that block sperm from attaching to ovum
_____ Monitor environmental availability of food and water, predators, diseases, reproduction, and habitat.
_____ Establish new herds
_____ Study tule elk ecology and population
_____ Administered in a dart

Elk Facts: True or False

T/ F Calves are born after 8.5 months gestation.
T/ F Average life span of wild elk is 12 years.
T/F Tule elk at Point Reyes National Seashore are threatened by many predators including the grizzly bear.
T/ F Both female and male tule elk have horns.

National Park System
List at least three units of the National Park System:

Stewardship
What can you do to support preservation of the elk population?
List ideas on the back of this paper.

Tule Elk

The Return of a Species

Sailing past the Point Reyes peninsula in the year 1800, explorers saw large herds of elk roaming through open grasslands. Sixty years later, the elk were gone from Point Reyes and by 1870 they were thought to be extinct statewide. Today, elk again roam along the hills of Tomales Point and several other areas within California. This is the story of their remarkable comeback.

Historic
Tule Elk Range
Population: 500,000

1870
Population: fewer than 10

1998
Population: 3,200

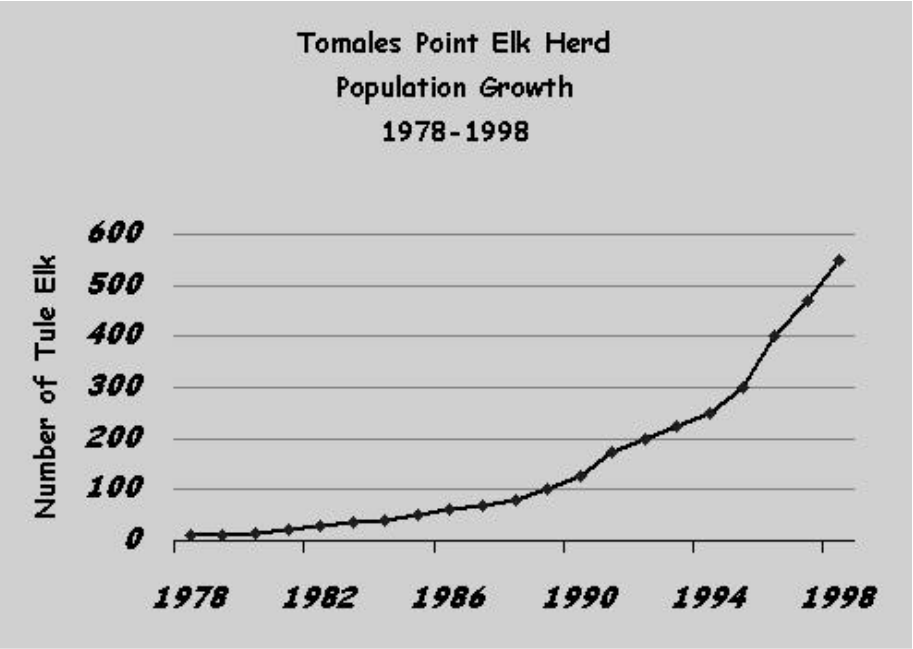
A Look into the Past

The tule elk (*Cervus elaphus nannodes*) is a subspecies of elk native to California. It occurs nowhere else. For thousands of years, as many as 500,000 tule elk thrived in California from the lush open country of the Central Valley to the grassy hills on the coast. But following the Gold Rush of 1849, the elk were hunted nearly to extinction. At the same time, elk habitat was converted to agriculture, and livestock grazed what had been elk forage. These developments caused the elks' decline and nearly caused their extinction.

Imagine the surprise of the ranch workers in 1874 who discovered several tule elk while draining a marsh to create agricultural fields. Not a single tule elk had been seen for four years! Fortunately the landowner, Henry Miller, felt compelled to protect these last elk, and by 1905 their population had grown to 140. When the elk began to eat Miller's crops and trample his fences, he captured some and moved them to other locations in California. This was the first time the elk were moved for conservation purposes. It was not to be the last.

Revival and Recovery

Tule elk received official protection in 1971 with state Senate Bill 722, called the Behr Bill after its author, Peter Behr. This bill prohibited hunting of tule elk–then numbering 500–until their population reached 2,000. As a result of management by the California Department of Fish and Game, the tule elk population grew to 2,000 in 1989. By 1998, there were more than 3,000 elk in California.



In 1976, Public Law 94-389 directed the federal government to make suitable lands available for "the preservation and grazing of tule elk." Two years later, ten tule elk were moved to Tomales Point, the northernmost part of Point Reyes National Seashore. There they survived a decade of drought. With the return of the rains in the early 1990s, range conditions improved dramatically and the elk herd grew rapidly. By 1998, the herd size surpassed 500 animals, one of the largest of the 22 herds currently in the state.

A Challenge for the Future

Today's tule elk population is larger than it has been for 130 years: 3,200 and growing. California's human population, now approximately 32 million, is also growing. As the human population expands, wildlife habitat is being converted to human habitat – housing, stores, schools, and highways. As a result, the elk have fewer and fewer places to roam. Tule elk will probably never return to their historic numbers nor to all of their historic range because of this human growth and lack of suitable elk habitat. But if they and other wildlife are to survive, human expansion into the landscape must be balanced with the need to maintain the treasured open spaces of California.

"We are the only species which, when it chooses to do so, will go to great effort to save what it might destroy."

Population Growth and Range Limitations

Since their reintroduction to the Point Reyes Peninsula, the tule elk have lived within a 2,600-acre reserve at Tomales Point. Their range is restricted by the Pacific Ocean to the north and west, Tomales Bay to the east, and a three-mile-long, ten-foot-tall fence to the south. Given the mild climate and lush habitat of Tomales Point, the elk live in a virtual paradise. As long as there is abundant rainfall and forage, they will continue to multiply.

Vitality and youth characterize the existing herd, as more than half the animals are less than five years old. Several hundred of the females are old enough to reproduce.

Fewer than 5 percent of the elk die each year; they have an average life span of twelve years. As the herd grows within the restricted Tomales Point area, they place a greater demand on their habitat. Without adequate rainfall, their forage could become deficient, causing them to suffer stress, starvation, and eventually a population crash.

Management Actions

Research

The Seashore will continue its intensive research effort, studying tule elk ecology and population dynamics. Researchers will explore methods to alter elk population size where and when necessary, look at abundance of food and water, predation, disease, and population control techniques. This research information will help the Seashore revise the management plan to accommodate new situations and changing conditions.

Relocation

As a scientific trial to establish the effectiveness of expanding their habitat, up to 70 elk have been moved to the Limantour wilderness area from the existing herd at Tomales Point. Working with other agencies, the Seashore will seek to relocate elk elsewhere in the state to establish new herds in the historic range.

Immunocontraception

Based on the recommendations of three scientific panels, the Seashore is studying a form of contraception called immunocontraception within the Tomales Point herd. The immunogen, administered in a dart, works by stimulating the cow's immune system to produce antibodies that block sperm from attaching to the ovum. This contraceptive is reversible and antibodies resulting from the vaccine do not pass through the food chain. This means there is no known environmental byproduct–no other plants or animals will be affected in any way. Annual booster shots may be necessary before the next breeding season. In August 1997, the Seashore began a pilot study of immunocontraception. Research will determine if this "elk birth control" can be used effectively with the future relocated elk population at Point Reyes National Seashore.

Elk add diversity and beauty to the Point Reyes Peninsula, restore the natural and cultural character of the land, and enrich our lives. As a result, we must be committed to making responsible choices that ensure the elk's survival.

The Point Reyes Solution

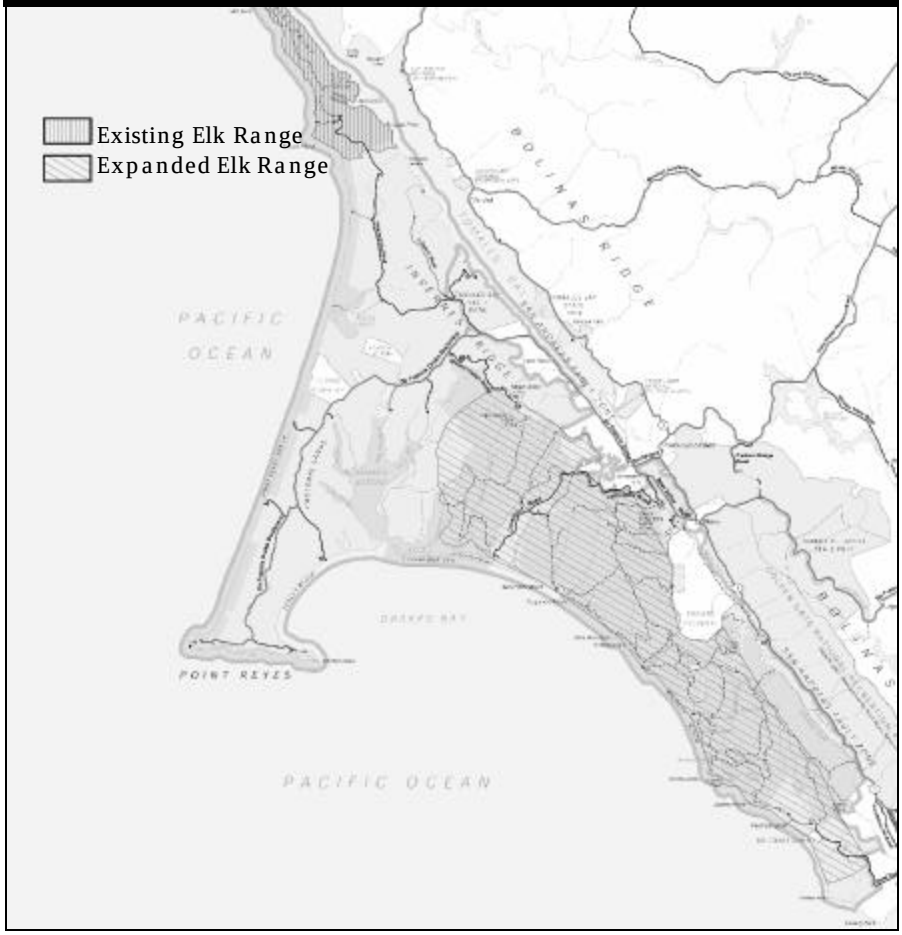
Since 1993, researchers and biologists from the National Park Service, U.S. Geological Survey, University of California at Davis and Berkeley, Humboldt State University, and the California Department of Fish and Game have studied the complex question of how to accommodate the growing elk herd. They looked at the herd's composition and size, incidence of disease, impact on endangered species, and the condition of the plant communities on Tomales Point. These studies provided the information necessary for the Park to develop a management plan to ensure the health of the herd.

After consideration of a number of alternatives and public review, the Park is implementing a scientific approach to manage the tule elk herd. The approach involves three major components: the continuation of research, relocation, and immunocontraception.

In the environmental assessment, several other options were explored but rejected:

- Sterilization was eliminated as an option because of its irreversibility and its intrusive, inhumane implications.
- Due to possible disease transmission and competition with cattle for forage, removing the elk fence at Tomales Point will not be considered as long as the adjacent dairy ranches are in operation.
- In order to leave the wildlife wild, the Park will not attempt to establish new herds that require permanently fenced, restricted ranges.
- Hunting elk within the Park is not an option because of strong public opposition and safety concerns.

Point Reyes Tule Elk Ranges



Elk Facts

Life Cycle

Female elk are sexually mature by two years of age, although they may be able to breed as yearlings. Nearly all female elk will reproduce during their lifetime. A female is likely to have six to ten calves in her lifetime. Males are sexually mature at age two, but usually aren't able to breed until they are strong enough to compete with other bulls to defend a harem of cows. Half the the male population will remain bachelors; most breeding is accomplished by ten percent of the male population.

Gestation period: Calves are born 8.5 months after conception. They nurse for four or five months, but start nibbling on grass when they are less than one month old.

Lifespan: Twelve years is an average lifespan for wild elk; some elk have been known to live 25 years in captivity.

Predators

The tule elk at Point Reyes National Seashore are practically free from predators.

Humans could kill elk with weapons, but hunting is not allowed in the Seashore.

Black and grizzly bears usually eat plants, but they would eat elk too. However, there are no longer bears in the park.

Coyotes are found at the Seashore, and will kill elk calves, but an elk's flailing hooves can easily kill a coyote. No coyote attacks on elk have been recorded in the Seashore.

Mountain lions can kill elk of any age, but find smaller deer an easier target. No mountain lion interactions with elk have been documented in the park.

Antlers vs. Horns

Antlers are often confused with horns. Horns are slow-growing and permanent, usually grown by both sexes, and are made of a bone core covered by a thin layer of keratin.

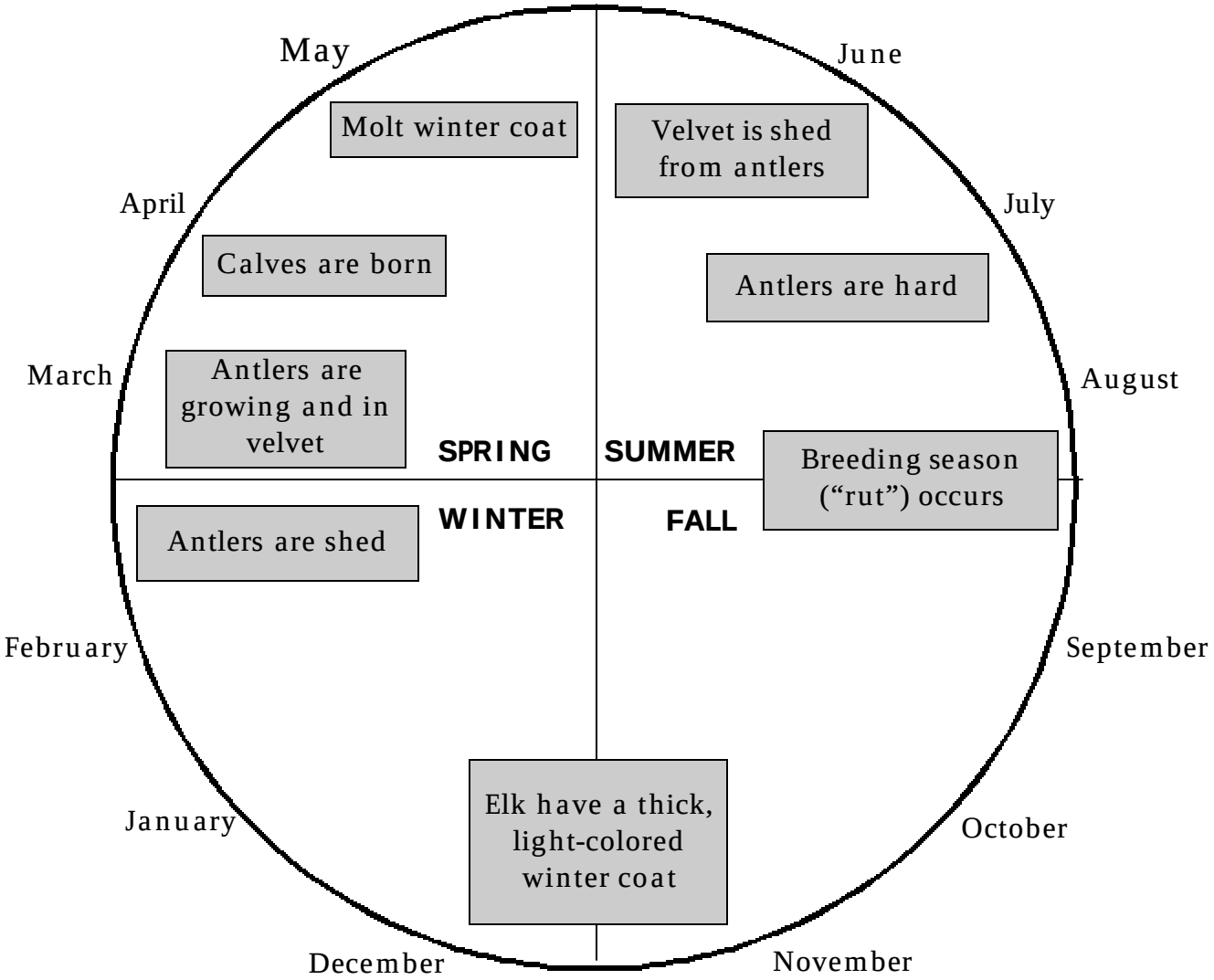
Antlers usually grow only on males and are made completely of bone. They are shed and regrown annually. In the spring, they are covered with "velvet," a system of blood vessels that nourish the bone as it grows. A set of elk antlers can weigh up to 40 pounds.

The size and symmetry of the antlers reflect the health as well as the age of the animal. A "spike bull" is less than two years old and has only one point on his antlers. Older bulls have more points, but they do not grow a point for each year of age.

Antlers are used as weapons by the males to compete for the chance to breed. A young bull is easily intimidated by a mature bull's large rack of antlers. Two evenly matched bulls may use their antlers in combat, if other attempts at intimidation (vocalizations and posturing) have failed.

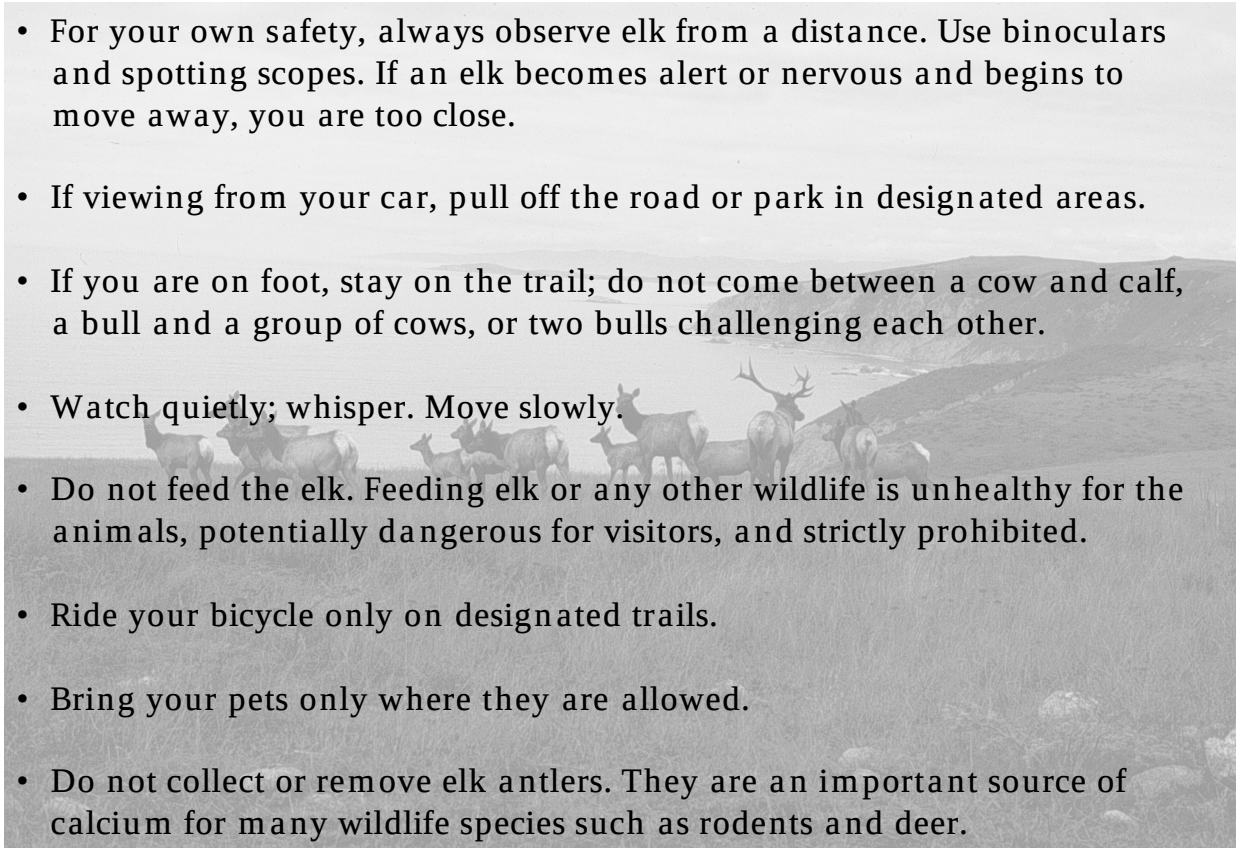
A bull who has proven himself bigger and stronger than the others defends a harem of up to 30 females. This means he is the primary bull, responsible for 80 percent of the breeding. Towards the end of the breeding season, other "secondary" bulls may get the opportunity to breed as the primary bull tires.

Annual Life Cycle of Tule Elk



	Winter/Spring	Summer/Fall
Population Groupings	cows, calves, yearlings	harems (one adult bull with cows, calves, and yearlings)
	bachelor groups (all adult bulls) lone bulls	bachelor groups lone bulls

Elk Watching Tips



- For your own safety, always observe elk from a distance. Use binoculars and spotting scopes. If an elk becomes alert or nervous and begins to move away, you are too close.
- If viewing from your car, pull off the road or park in designated areas.
- If you are on foot, stay on the trail; do not come between a cow and calf, a bull and a group of cows, or two bulls challenging each other.
- Watch quietly; whisper. Move slowly.
- Do not feed the elk. Feeding elk or any other wildlife is unhealthy for the animals, potentially dangerous for visitors, and strictly prohibited.
- Ride your bicycle only on designated trails.
- Bring your pets only where they are allowed.
- Do not collect or remove elk antlers. They are an important source of calcium for many wildlife species such as rodents and deer.

How You Can Help the Elk

A number of organizations are concerned about the welfare of elk in California and throughout the U.S.A. They provide a range of services, from educational materials to buying and managing land for elk habitat. You can get involved in a number of ways, among which are the following:

☐ Donate–Give to and help raise money for agencies and nonprofit groups that protect habitat.

☐ Protect Habitat–Prevent domestic dogs from roaming. Follow Park regulations and guidelines listed here and at trailheads.

☐ Learn–Find out more about elk from the organizations listed below. Share information with friends and family.

☐ Volunteer–Be an elk docent on summer and fall weekends at Point Reyes National Seashore. Call (415) 464-5195, for an application.

National Park Service 1998

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Line Drawings: Patricia Kirby
Photo Credits: Gary Nichols, Patricia Kirby, and Phil Jonik

Answer the following questions based on information in the newspaper, your ideas, and your understanding.

A Look into the Past

1. What happened to the tule elk population after the Gold Rush of 1849?
   The population dropped from 500,000 to 10.

2. What happened in 1874 that significantly affected tule elk?
   Ranch workers discovered several tule elk and the landowner protected them.

Revival and Recovery

3. What officially protected tule elk? When?
   The Behr Bill officially protected them in 1971.

The Point Reyes Solution

4. It is legal to hunt tule elk in some areas; however, hunting tule elk is not permitted at Point Reyes National Seashore. What threats exist for elk at Point Reyes? Can anything be done to prevent some of these threats?

   Disease, restricted habitat, and overpopulation all influence population numbers at Point Reyes. Research and medication can help prevent disease. Establishing free-ranging herds, like the one near Limantour Beach, can expand the habitat for the tule elk at Point Reyes. Immunocontraception and relocation can help control overpopulation.

5. Does their reintroduction into Point Reyes National Seashore help provide a better future for tule elk in California? How?

   Yes. The herd at Point Reyes is the second largest in the state. Point Reyes provides good habitat and protection, enabling the population to continue to recover.

Activity Master

6. What options are being considered at Point Reyes to manage the population of the Tomales Point herd? Compare the positive and negative impacts.

Option	Positive	Negative
1. immunocontraception darting	reversible; does not affect the food chain	requires annual darting
2. relocation	establishes a free-ranging herd	expensive; requires difficult capture techniques; few relocation sites available
3. research	gives management information to make informed decisions	expensive and staff intensive; must ask the right questions to get answers that will help the most in decision making; takes time
4. natural regulation	true to natural ecosystem functioning less time intensive	outcomes unpredictable
5. culling (lethal removal)		

Making Responsible Choices for the Future

7. If you were the Superintendent of Point Reyes National Seashore, what option(s) (listed above) would you choose? Why?

Answers will vary

8. What do you think will happen to the tule elk population in the next 10 years? Why?

Answers will vary; it may continue to grow until the population crashes, a drought may limit reproduction, relocations of elk may continue, immunocontraception may become effective.

Name _____ **Date** _____

Activity Sheet

Tule Elk Newspaper Activity

The Return of a Species

Answer the following questions based on information in the newspaper, your ideas, and your understanding.

A Look into the Past

1. What happened to the tule elk population after the Gold Rush of 1849?

2. What happened in 1874 that significantly affected tule elk?

Revival and Recovery

3. What officially protected tule elk? When?

The Point Reyes Solution

4. It is legal to hunt tule elk in some areas; however, hunting tule elk is not permitted at Point Reyes National Seashore. What threats exist for elk at Point Reyes? Can anything be done to prevent some of these threats?

5. Does their reintroduction into Point Reyes National Seashore help provide a better future for tule elk in California? How?

Activity Sheet

Name _____ **Date** _____

Tule Elk Newspaper Activity

The Return of a Species

6. What options are being considered at Point Reyes to manage the population of the Tomales Point herd? Compare the positive and negative impacts.

Making Responsible Choices for the Future

Option	Positive	Negative
1.		
2.		
3.		

7. If you were the Superintendent of Point Reyes National Seashore, what option(s) (listed above) would you choose? Why?

8. What do you think will happen to the tule elk population in the next 10 years? Why?

What Is a Tule Elk?

Students will research and present information about adaptations, behaviors, and life cycles of tule elk. Students will also discover connections between seasons and behaviors to predict observations during their upcoming visit to Point Reyes National Seashore.

Time required: 2 hours

Location: classroom/homework

Suggested group size: pairs

Subject: science

Concepts covered: ecology, biology, animal behavior

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Maura Fallon-McKnight, and Kim Linse, Point Reyes National Seashore

Last updated: 03/25/01

Student Outcomes

At the end of this activity, the students will be able to:

- Identify at least three tule elk adaptations.
- Predict one tule elk behavior prior to field visit.
- State a connection between the seasons and tule elk behaviors occurring at time of field trip.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a - food webs
- 5b - organisms and the physical environment
- 6a - utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process

7th grade
- 3a - both genetic variation and environmental factors are causes of evolution and diversity of organisms
- 5a - animals have levels of organization for structure and function
- 7b - utilize a variety of print and electronic resources

Pre-Visit Lesson Plan

7c - communicate logical connections
7e - communicate the steps and results from an investigation

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Think critically and logically to make the relatioships between evidence and explanations
- Content Standard C - Structure and function in living systems; Reproduction and heredity; Regulation and behavior; Populations and ecosytems; Diversity and adaptations of organisms

Materials

To be provided by the teacher:

- Resource books or computer access for students to answer questions
- Overhead projector (or chalkboard)

To be photocopied from this guide:

- **What Is A Tule Elk?** Activity Sheet (one copy per class)
- Optional: **Tule Elk Visual Aid**

Vocabulary

annual life cycle, bachelor group, bugle, harem, herbivore, molt, ruminant, rut, thrash, velvet

Procedures

1. Review

Summarize some of the key points learned about tule elk from the first lesson plan. Inform students that they will be learning about elk in more detail through their own research. Each group of students will research answers to questions and present their findings to the class.

Before beginning this lesson, gather materials that students may use to answer questions or allow access to a computer (see **Resources** section at end of guide for suggested books and Internet sites).

2. Distribute activity sheet

Form up to nine groups of students. Each group will receive a section of the **What Is a Tule Elk?** activity sheet. Remind students that each group will be responsible for presenting their findings to the class. Encourage students to create visual aids or other methods of sharing their information with the class.

If you feel the questions are too difficult (or students do not have access to resources they can use to answer the questions) supply students with questions from the master sheets (showing answers). Students can still use that information for their presentation, or use the answers provided as a guide for further research.

3. **Presentations**
   Invite each group to the front of the class for a brief presentation of their results. Encourage other students to ask each group at least one question. An overhead projection of the **Tule Elk Visual Aid** or a student's drawing of an elk on the blackboard may assist students with their presentations.

4. **Discussion**
   Return to Group H's second question referring to the annual life cycle of tule elk. What are the connections between what is happening in the elk's life cycle and the events associated with the seasons? Use the life cycle chart provided in *Tule Elk: The Return of a Species* Newspaper.

   Why is the winter coat molted in the spring?
   To get rid of it before the warmer months start; it is no longer needed.
   Why do antlers start growing in the spring?
   This is the season with the most food.
   Why are calves born during spring?
   This is the season with the most favorable weather and food.
   Why are antlers shed in winter?
   They are no longer needed for premating activities; they would also require a portion of the scarce energy (food) available to elk in the winter.
   What activities can you expect of the tule elk during your class visit?
   Answers will vary.

Extension Ideas

1. Compare/contrast life cycles of other species (plants, cows, mountain lions, badgers) as they relate to the tule elk.

2. Have students sketch the three subspecies of elk found in California, showing their comparative size to each other. Assign one group to draw a map showing the habitat range for each of these elk in the state. Discuss the different habitat preferences of each species.

3. Compare/contrast the four species of deer that live at Point Reyes National Seashore: tule elk, black-tailed deer, axis deer, and fallow deer. Discuss their different histories - one has been here "forever" (black-tailed deer), one was extirpated, relocated, and is now recovering (tule elk); the other two were introduced from overseas for hunting (axis and fallow deer). What are their similarities? How are they different? For example, black-tailed deer are not a herding species as are the elk. They have slightly different diets (black-tailed deer eat more shrubs). How might the nonnative species effect the native species in Point Reyes National Seashore (competition for habitat, food, etc.)?

Group A

Use the chart below to organize the information from the following questions:

1. What is the scientific name for elk(genus and species)?
2. What are the three subspecies of elk found in California today?
3. What are the relative sizes (such as length/weight) of each subspecies?

ELK (genus/ species):	*Cervus elaphus*		
Subspecies (common name):	*tule elk*	*rocky mountain elk*	*roosevelt elk*
Subspecies (latin):	*nannodes*	*nelsoni*	*roosevelti*
Total length:	*80 inches*	*95.4 inches*	*92 inches*
Tail length:	*5.5 inches*	*5.6 inches*	*4.5 inches*
Cow (lbs.):	*411 pounds*	*445 pounds*	*500 pounds*
Bull (lbs.):	*554 pounds*	*730 pounds*	*1,054 pounds*
Other:			

What is an ungulate? What other animals are related to tule elk?

An ungulate is a mammal with hooves (horses, cattle, deer, swine, and elephants). Elk are in the deer family, known as "Cervidae". Moose, caribou, and deer are closely related to elk.

In order of size, largest to smallest:

Moose: ***cow = 700 pounds, bull = 1,000 pounds***
Elk: ***cow = 410-500 pounds, bull = 500-1,000 pounds***
Caribou: ***cow = 300 pounds, bull = up to 500 pounds***
White-tailed/ black-tailed deer: 180 to 275 pounds.

Activity Master

Group B

How do tule elk digest their food?
Describe the four-chambered stomach.
What is the name for an animal with a four-chambered stomach?

An elk's stomach can extract nutritional value from tough plant fibers. A healthy elk will eat 15 pounds of twigs, leaves, and grasses in one day.

The elk bites and swallows food to the first chamber called the rumen. This is a "holding tank" where the food begins to break down with the help of bacteria. Then the elk regurgitates the food (cud) and ruminates (chews thoroughly) for several hours. The elk chews, swallows, and burps the cud back to be chewed again, until the particles are small enough to pass through the rumen. The second chamber is the reticulum where different bacteria digest the food further. The third chamber is the omasum, where water is squeezed out of the food and absorbed into the elk's body. The last chamber is the abomasum, where the food is broken down to the molecular level so that is can be absorbed by the intestine. This is an adaptation that helps elk get their food quickly (in open, exposed areas where they can be seen easily by predators) and find cover to chew and digest safely and out of sight of predators.

An animal with a four-chambered stomach is a ruminant.

Group C

How do researchers determine the age of an elk?

Sketch the parts of the elk's body that helps researchers determine age.
Why are they shaped the way they are?

Researchers look at the teeth to determine the age of an elk. The amount of wear on the molars and the number of adult teeth that have replaced "baby" incisors and premolars are indicative of age. If researchers can obtain a tooth, they can slice it and count the rings in a cross-section: like trees, elk teeth have annual growth rings! The flat teeth grind plant material well.

Upper tooth

Lower tooth

Group D

Does elk activity in an area impact other species or their shared habitat?
What other living things share the habitat with elk?
What does grazing do to plants?
What do elk hooves do to the soil and/or plants?

Their grazing and browsing stimulate growth in some plants and can reduce competition among the plants.

Deer and elk share the same habitat and some of the same food. When the habitat is healthy, many animals can share the resources and coexist well. When quality or quantity declines, competition increases. Some species and some individuals within a species will suffer as a result of this competition.

Their hooves break up soil as they move about, which creates depressions that hold water and nutrients, and provides space for seeds to germinate.

Group E

Describe the mating season behaviors of male elk. What are antlers, bugles, harems, and wallows?

Antlers help bulls fight and establish their dominance hierarchy-the antlers are fully grown by August. Bulls display these antlers and will usually decline a fight if the other bull shows larger antlers. Mature bulls will sustain injuries, but rarely die as a result of a fight.
During the rut, bulls bugle and fight. The larger bulls' bugles have a deeper pitch than the younger, smaller bulls.
Dominant bulls work to maintain their status by patrolling a harem (group of cows), chasing other bulls away, and copulating with the cows when they come into estrus.
A wallow is a muddy area where bulls roll around to cool off, spread their scent evenly over their body, and make themselves look and smell even more imposing.

How do the bull elk's behaviors change after the rut season is over?

The dominant bulls don't fight with the other bulls, they don't bugle, and they hang out with other bulls. The behavior of the bachelor bulls doesn't change significantly. The prime bulls leave the harems and join bachelor groups or stay solitary.

Activity Master

Group F

Explain the purpose of three different sounds made by elk (squeal, bark, high-pitched squeal, bugle).

Vocalizations are rare, usually only heard during the rut or when the elk are in danger.

> ***<u>Squeal/Mew/Chirp</u>: general conversation in a harem.***
> ***<u>Bark:</u> warning of danger, usually between cows or mother and calf.***
> ***<u>High-pitched squeal:</u> newborn to its mother, bonding and recognition, when faced with danger.***
> ***<u>Bugle</u>: bull warning other bulls to stay away, announcing his readiness to fight, or advertising to potential cows that he's the one they want to breed with. It's a bellow that escalates to a squealing whistle and ends with a grunt.***

Explain the purpose of three different nonverbal communication techniques or behaviors used by elk. To the best of your ability, demonstrate each behavior! (example: locking antlers, boxing...)

<u>Grimace:</u> A bull sticks his head forward and upward while curling back his upper lip. He is "testing" the air to see if a female is in estrus (ready to breed).

<u>Thrashing:</u> A bull uses his antlers to thrash the ground or vegetation.

<u>Charge:</u> A male lunging at another either as a threat or in the beginning of a battle.

<u>Locking Antlers:</u> During a serious battle, two bulls will lock antlers and try to throw one another off balance.

<u>Boxing:</u> Two cows rear up on their back legs and clash their hooves. This display is believed to be a sign of aggression. Antlerless males also box.

<u>Predator Avoidance:</u> For the first few weeks of life, a newborn calf is protected by remaining close to its mother, separate from the herd, and lying still in surrounding vegetation. Calves have little scent so as not to attract predators, and the white spots on the calf's coat help to camouflage it.

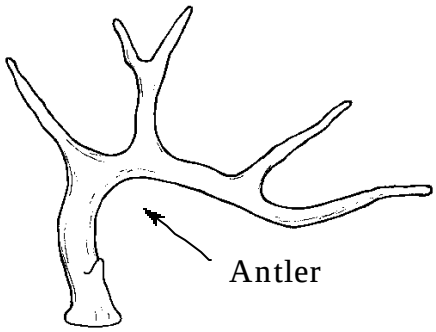
<u>Bedding Down:</u> Lying down to rest, sleep, or ruminate.

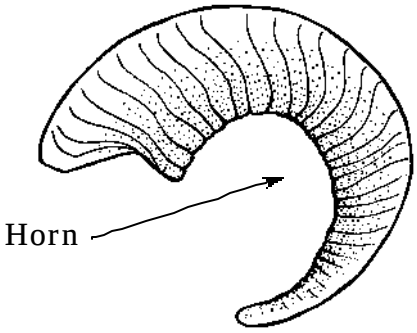
Group G

What is the difference between antlers and horns?
Sketch an example of each.

Antlers are made of bone (the fastest growing bone of any mammal) and are shed and regrown every year. They are grown only by males (except in caribou). Antlers usually have branches or spikes.

Horns are usually grown by males and females. They are made of keratin (same material as your fingernails) that grows slowly around a small core of bone. Horns are permanent; they are not shed. Horns usually grow in "rings" that mark the animal's age.





Describe antler development. How are they grown and shed every year? Do antlers play a role in the ecosystem after they are shed?

Growth: Increasing amounts of daylight (March/April) trigger more testosterone to be produced in the elk's blood. This stimulates layers of cartilage to grow which mineralize into bone. Antlers can grow as fast as an inch a day in the summer months! Velvet protects and carries blood to the growing bone tissue. The blood stops flowing to the antlers in July/August when the antlers become hard and the velvet peels, or is rubbed off. Grooves on the antlers show the locations where veins carried blood to the growing antlers.

Shedding: In October, after the rut, testosterone levels gradually decline until it is hardly being produced at all. Eventually, the antlers simply fall off, or are shed, one at a time. Some bleeding may occur, but it heals quickly. The older bulls shed first, in late February or March, while some yearling bulls retain their antlers until May.

Antlers play an important role in the ecosystem after they are shed. They are gnawed on by rodents and deer, slowly broken down, and they ultimately decompose. Calcium is difficult to find in nature, and antlers provide an important calcium supplement.

Activity Master

Group H

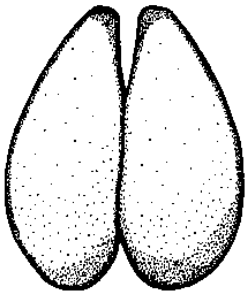
How do tule elk coats change from winter to summer? Why do they change?

The coat is much heavier in the winter to keep the elk insulated. As summer approaches, the elk will molt so that it does not overheat during long, hot summer days. In the summer heat, the light-colored coats reflect the hot sun. In the winter, the hair grows long and becomes dull in color.

Using **The Annual Life Cycle of Tule Elk** found in the *Tule Elk: The Return of a Species* newspaper, determine what you expect to see in the month your class will be visiting the Seashore.

Answers will vary

Draw an elk track.



An elk track looks like a large deer track. It's a mirror image, two-sided print, tapered toward the front and round at the top

Why do elk have white rumps?

It's believed to be a form of warning coloration and a way for other elk to find the herd.

Group I

How old is a female tule elk when she can give birth to her first calf? What is the gestation period for tule elk? How many months does the calf nurse?

A female tule elk is sexually mature by two years of age. The gestation period for tule elk is 8.5 months and the young are born from mid-May through early July. A calf will nurse for four or five months or longer (yearlings have been observed nursing).

What are scent glands? Where are they and what do they do?

Scent glands are any of various specialized skin glands, occurring in many kinds of animals, that emit an odor commonly functioning as a social or sexual signal or a defensive weapon. Scent glands are located: on the external part of the hind leg, just below the hock (lower joint, corresponding anatomically to the ankle in humans); on the belly, near the penis (also called the belly patch); around the vagina and anus in females; in the hollow cavity anterior to the eye; around the hair follicles at the velvet of growing antler; on the ventral (toward the belly) side of the tail.

How are elk eyes and ears adapted to help them live?

The eyes are located on the sides of their heads, enabling them to see predators for almost 360 degrees. The ear shape and large size help to capture and channel sound.

Name _____ **Date** _____

Activity Sheet

What Is a Tule Elk?

Group A

Use the chart below to organize the information from the following questions:

1. What is the scientific name for elk (genus and species)?
2. What are the three subspecies of elk found in California today?
3. What are the relative sizes (such as length/weight) of each subspecies?

ELK (genus/ species):			
Subspecies:			
Total length:			
Tail length:			
Cow (lbs.):			
Bull (lbs.): or sketch:			
Other:			

What is an ungulate? What other animals are related to tule elk?

Group B

How do tule elk digest their food?
Describe the four-chambered stomach.
What is the name for an animal with a four-chambered stomach?

Activity Sheet

Name _____ **Date** _____

What Is a Tule Elk?

Group C

How do researchers determine the age of an elk?

Sketch the parts of the elk's body that help researchers determine age.
Why are they shaped the way they are?

Group D

Does elk activity in an area impact other species or their shared habitat?
What other living things share the habitat with elk?
What does grazing do to plants?
What do elk hooves do to the soil and/or plants?

Group E

Describe the mating season behaviors of male elk. What are antlers, bugles, harems, and wallows?

How do the bull elk's behaviors change after the rut season is over?

Group F

Explain the purpose of three different sounds made by elk (squeal, bark, high-pitched squeal, bugle).

Explain the purpose of three different non-verbal communication techniques or behaviors used by elk. To the best of your ability, demonstrate each behavior! (example: locking antlers, boxing...)

Name _____ **Date** _____

Activity Sheet

What Is a Tule Elk?

Group G

What is the difference between antlers and horns?
Sketch an example of each.

Describe antler development. How are they grown and shed every year? Do antlers play a role in the ecosystem after they are shed?

Group H

How do tule elk coats change from winter to summer? Why do they change?

Using **The Annual Life Cycle of Tule Elk** found in the *Tule Elk: The Return of a Species* newspaper, determine what you expect to see in the month your class will be visiting the Seashore.

Draw an elk track.

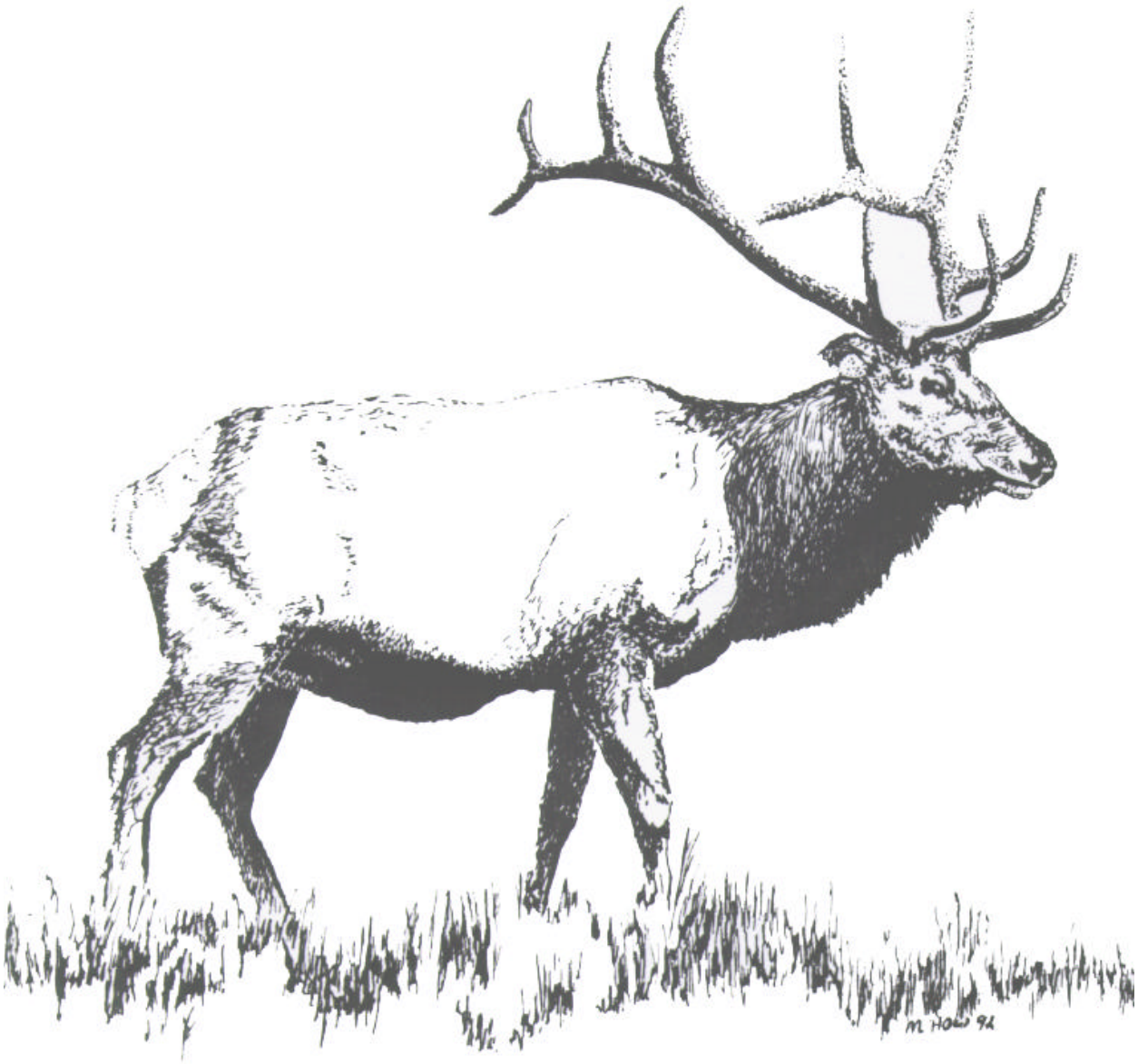
Why do elk have white rumps?

Group I

How old is a female tule elk when she can give birth to her first calf? What is the gestation period for tule elk? How many months does the calf nurse?

What are scent glands? Where are they and what do they do?

How are elk eyes and ears adapted to help them live?



How Is Tule Elk Research Done?

Students will explore techniques that are used by scientist at Point Reyes National Seashore to monitor tule elk herds. Students will also imitate one method used to locate an elk due for an immunocontraceptive booster shot. This is an in-class activity illustrating one research tool. If students are aware of these research methods prior to their upcoming field visit to Point Reyes National Seashore, their onsite observations will be more focused and meaningful.

Time required: 1 hour

Location: classroom

Suggested group size: entire class

Subject: science research

Concept covered: wildlife management

Written by: Josh Risley, Tomales School, Kim Linse and Lynne Dominy, National Park Service

Last updated: 03/25/01

Student Outcomes

At the end of this activity, the students will be able to:

- Understand how researchers raise and answer questions
- Explain different types of research tools used to study wildlife

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5b - organisms and the physical environment
- 5e - numbers and types of organisms an ecosystem can support depends on the resources available
- 7c - develop qualitative statements about the relationships between variables
- 7d - communicate the steps and results from an investigation
- 7f - interpret a simple scale map

Pre-Visit Lesson Plan

Creating Coastal Stewardship through Science

Pre-Visit Lesson Plan

7th grade	7a - appropriate tools and technology to perform tests, collect and display data 7c - communicate logical connections
8th grade	9c-distinguish between variable and controlled parameters in a test

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Identify questions that can be answered through scientific investigations; use appropriate tools and techniques to gather, analyze, and interpret data; Think critically and logically to make the relationships between evidence and explanations
- Content Standard C - Reproduction and heredity; Regulation and behavior; Populations and ecosystems
- Content Standard F - Populations, resources, and environments
- Content Standard G - Science as human endeavor; Science and technology in society

Materials

To be provided by the teacher:

- rulers, one per student

To be photocopied from this guide:

- **Research Questions and Tools** Activity Sheet
- T**omales Point Elk Location Grid** Activity Sheet

Vocabulary

immunocontraception, radio collar, radio telemetry, wildlife management

Procedures

1. **Introduction**
   Introduce wildlife management and research management tools to students. Explain that wildlife management is the application of scientific knowledge and technical skills to protect, preserve, conserve, or enhance the value of wildlife and its habitat. Examples of management tools include examples mapping, photography, observation, and population counts.

2. **Research Questions and Tools activity sheet**
   Provide each student with the **Research Questions and Tools** activity sheet. In the column on the left, students should list all of the questions that tule elk researchers might have. When they are finished with the column on the left, each question or group of questions should have a corresponding, appropriate tool listed on the right. Students may complete this worksheet individually or as an entire class, using the blackboard to record their ideas. Use the activity master to review their work or initiate brainstorming.

3. Tomales Point Elk Location Grid activity sheet

Each student will have an opportunity to mimic a method used to locate individual elk in the field. Provide each student with the **Tomales Point Elk Location Grid** activity sheet and a ruler. Set the scene with the following information:

> *You are a wildlife biologist, administering immunocontraceptive booster shots to the female tule elk at Point Reyes National Seashore. It's a foggy day and you're working with a partner, trying to locate one specific elk. Each elk that needs to receive a booster shot is wearing a radio collar. Each collar emits a radio frequency beep pattern, or signal. You're carrying a radio telemetry receiver, equipped with a radio antenna and headset so you can listen to the beeps emitted from the radio collars. You have a list of the cows and their assigned signals or collars. To find "your" elk, you and your partner hike to different locations (Water Tank and Upper Pierce Ranch) and point your radio antennae around until you hear the specific signal given off by the cow's radio collar. From your different locations, you take compass readings and record the direction from which the signal is coming. To find the exact location of the elk, you use these two directions from each of your locations. Where the directions intersect is the exact location of the elk you're looking for.*

Instruct students to locate Upper Pierce Ranch and the Water Tank on their maps. Students should draw a line directly north from Upper Pierce Ranch and directly southeast from the Water Tank. Where the two lines intersect is the location of the elk. Now, as researchers, the students would need to hike to that location to administer the elk's immunocontraceptive booster shot.

4. Discussion

How does information gained in research effect the way the area and organisms are managed? For example: what actions would be taken if it was found that the population was too low or too high?

5. For 8th grade students

Form small student groups and assign each group a separate research question from the **Research Questions and Tools** activity sheet. Instruct each group to design a research project revolving around that question which distinguishes between variable and controlled parameters in a test.

Research Questions and Tools

In the column on the left, list as many questions as you can think of that tule elk researchers might have. In the column on the right, brainstorm research tools that could be used to find answers to these questions.

Questions	Research Tools
What is the size of each elk's home range?	***radio collar tracking and mapping***
What habitats do they prefer?	***radio collar tracking and mapping, observations***
Are the elk alive? Have any elk died?	***radio collar tracking with mortality mode motion sensors, obervations***
What has caused an elk to die?	***blood samples, necropsy***
How many elk live at Point Reyes?	***observations, population counts, pellet counts***
How many calves are born each year? What is the population growth rate?	***population counts, radio-collaring and monitoring of cows***
Are diseases affecting the survival of the elk?	***fecal collection, blood samples, necropsy***
What impact are the elk having on the habitat?	***elk exclosures, photography, plant transects, water quality measurements, aerial photography of elk trails, small mammal trapping for population estimates***
What do the elk eat?	***fecal collection, observations, necropsy, exclosures***
What behaviors are most common? How do they vary throughout the year?	***observations, remote cameras (possibly in the future)***

Name _____ **Date** _____

Research Questions and Tools

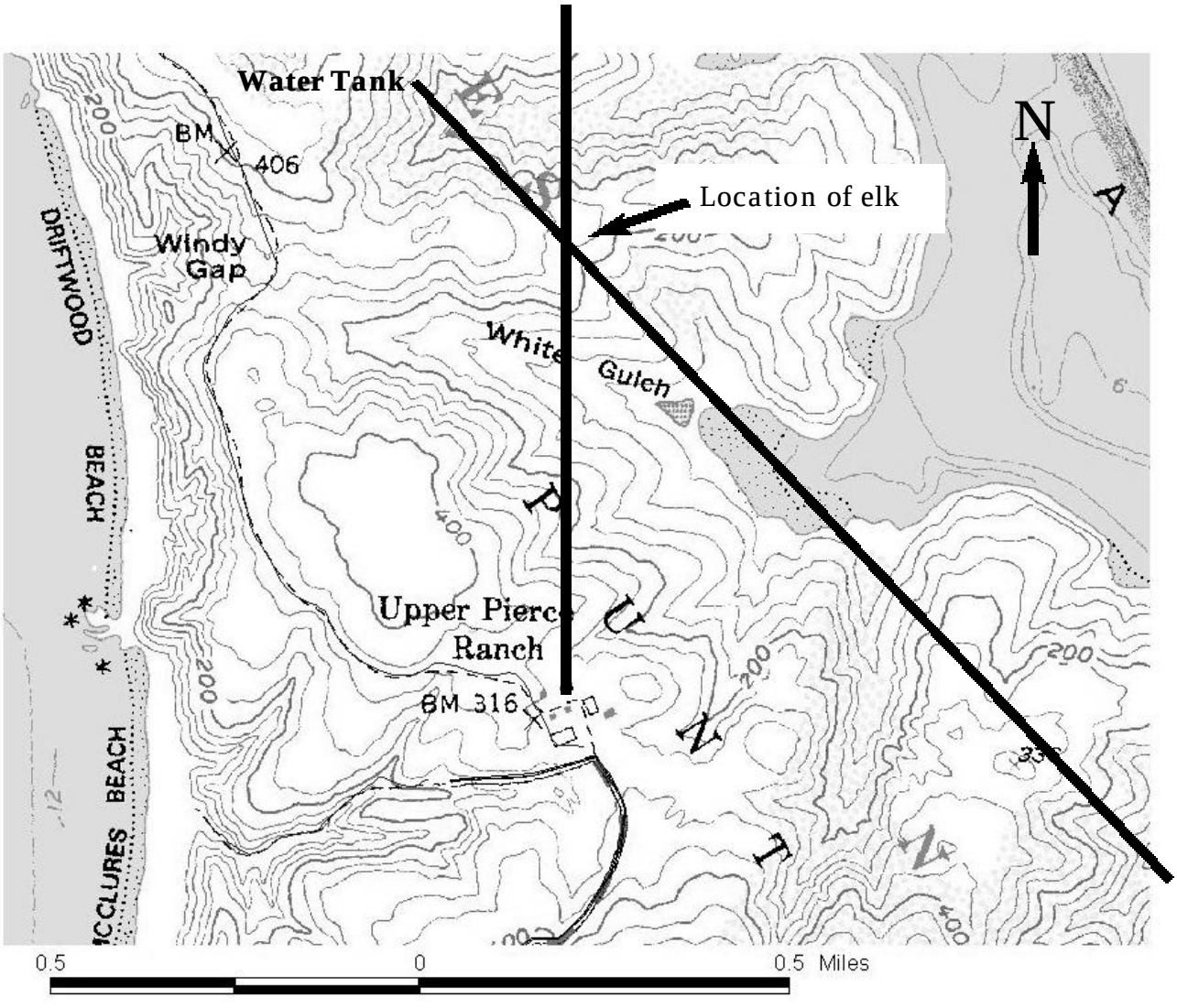
Activity Sheet

In the column on the left, list as many questions as you can think of that tule elk researchers might have. In the column on the right, brainstorm research tools that could be used to find answers to these questions.

Questions	Research Tools

Tomales Point Elk Location Grid

You are a wildlife biologist, administering immunocontraceptive booster shots to the female tule elk at Point Reyes National Seashore. It's a foggy day and you're working with a partner, trying to locate one specific elk. Each elk that needs to receive a booster shot is wearing a radio collar. Each collar emits a radio frequency "beep" pattern, or signal. You're carrying a radio telemetry receiver, equipped with a radio antenna and headset so you can listen to the beeps emitted from the radio collars. You have a list of the cows and their assigned signals or collars. To find "your" elk, you and your partner hike to different locations (Water Tank and Upper Pierce Ranch) and point your radio antennae around until you hear the specific signal given off by the cow's radio collar. From your different locations, you take compass readings and record the direction from which the signal is coming. To find the exact location of the elk, you use these two directions from each of your locations. Where the directions intersect is the exact location of the elk you're looking for. The signal from the Water Tank came from the southeast and the signal from Upper Pierce Ranch came from directly north. Use this information to locate your elk.

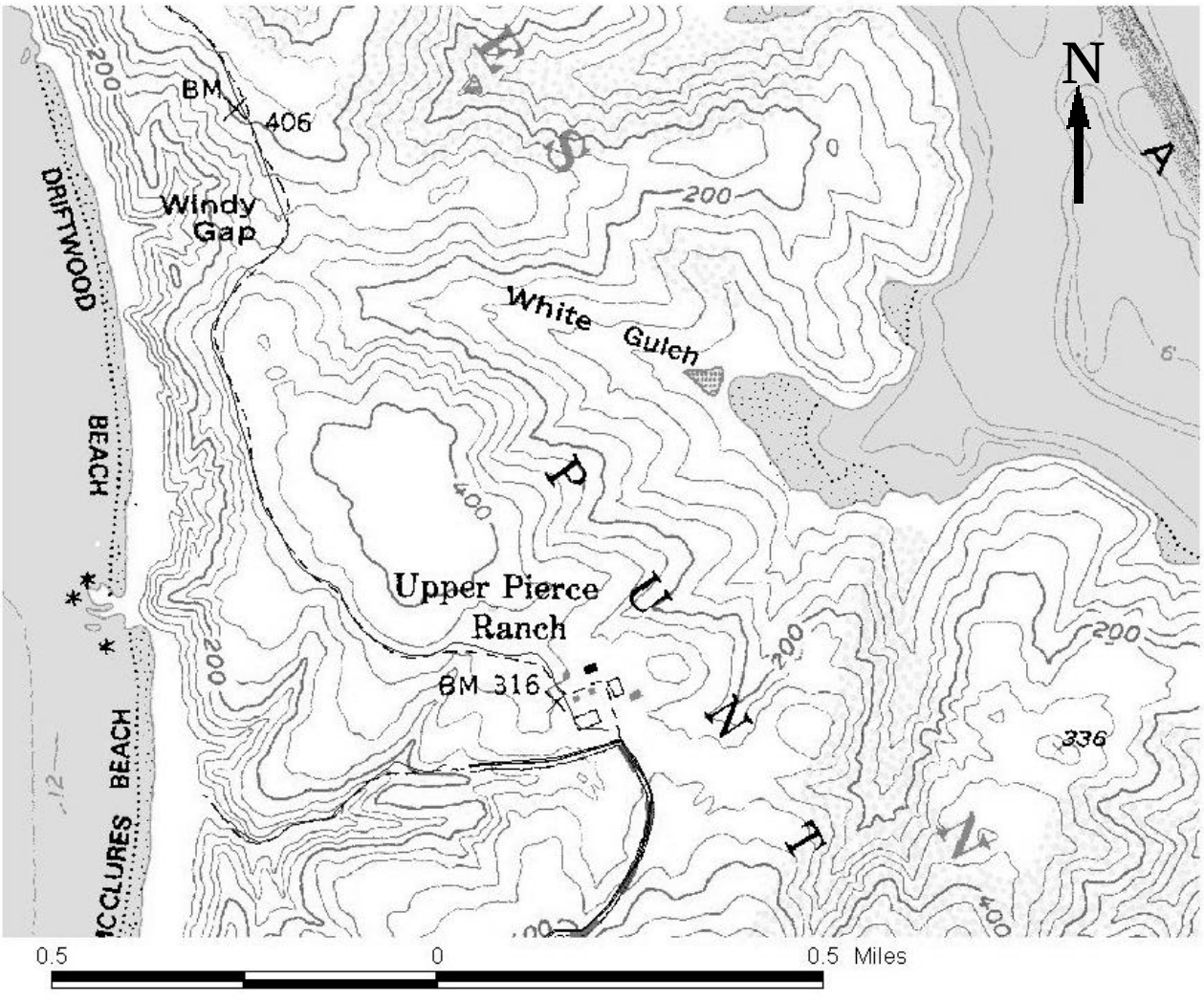


Name _____ **Date** _____

Activity Sheet

Tomales Point Elk Location Grid

You are a wildlife biologist, administering immunocontraceptive booster shots to the female tule elk at Point Reyes National Seashore. It's a foggy day and you're working with a partner, trying to locate one specific elk. Each elk that needs to receive a booster shot is wearing a radio collar. Each collar emits a radio frequency beep pattern, or signal. You're carrying a radio telemetry receiver, equipped with a radio antennae and headset so you can listen to the beeps emitted from the radio collars. You have a list of the cows and their assigned signals or collars. To find "your" elk, you and your partner hike to different locations (Water Tank and Upper Pierce Ranch) and point your radio antennae around until you hear the specific signal given off by the cow's radio collar. From your different locations, you take compass readings and record the direction from which the signal is coming. To find the exact location of the elk, you use these two directions from each of your locations. Where the directions intersect is the exact location of the elk you're looking for. The signal from the Water Tank came from the southeast and the signal from Upper Pierce Ranch came from directly north. Use this information to locate your elk.



Radio Collaring Tule Elk

Individual elk that are involved in scientific research are fitted with radio collars. Each collar is uniquely color-coded, and each collar has a transmitter and battery in a metal box that hangs under the animal's neck. The transmitter sends a unique signal every other day which biologists listen to with radio receivers. They transmit their signal for up to five years. These signals can only be heard with specialized equipment-they cannot be heard with the human ear.

The collars also have unique color codes. If you see a collar with an orange stripe, the elk wearing that collar is part of the immunocontraceptive study.

Only cows are collared at Tomales Point, and in 2000, a total of 90 animals had collars. At Limantour, 16 cows are collared.

How are the elk fitted with their radio collars? Each elk was captured individually to place the collars. First a net was thrown over the elk from a helicopter, then it was hobbled (four legs tied together) and blindfolded (this helps calm the elk). Then the scientist secured the collar around the elk's neck. Some collars are made to break away after a few years, while others will remain for life.

In order to learn where the elk go and how they utilize their habitat throughout the seasons, biologists follow the elk and record their locations.

What Can We Expect on Our Field Trip to the Tule Elk Reserve?

Students will prepare for upcoming field visit by constructing journals and reviewing personal field trip expectations. It is very important that students are familiar with these journals prior to their visit. This will allow students to maximize their time viewing elk, rather than receiving instruction.

Time required: 1 hour

Location: classroom

Group size: all

Subject: science

Concept covered: preparation for scientific survey

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service

Adapted by: Kim Linse and Melinda Repko, National Park Service

Last updated: 06/01/01

Student Outcomes

At the end of this activity, the students will be able to:

- Effectively utilize field journals while viewing tule elk.

California Science Standards Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade	7b - appropriate tools and technology to perform tests, collect data, and display data
7th grade	7a - appropriate tools and technology to perform tests, collect data, and display data
	7c - communicate logical connections
8th grade	9a - plan and conduct a scientific investigation to test a hypothesis

Pre-Visit Lesson Plan

National Science Standard Links (Grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Use appropriate tools and techniques to gather, analyze, and interpret data; understanding about scientific inquiry
- Content Standard G - Science as a human endeavor; Nature of science: students formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models

Materials

To be photocopied from this guide:

- **Field Journals** for each student (located with **How Do Researchers Survey Tule Elk?** on-site lesson)
- **Field Journals** for each chaperone so they can assist students while on the field trip
- Optional: activity sheet from **How Can I Capture My Experience in a Story, Poem, or Drawing?** on-site lesson, based on teacher/student interests

Available for reservation at Bear Valley Visitor Center:

- Tule Elk Field Trip Kit: 20 pairs of binoculars, spotting scope, etc.

Procedures

1. **Logistics to Consider Before Field Trip**

   Make reservations for Tule Elk field trip and kit reservation by using the Reservation form provided in the Teacher Preparation section of this guide.

   There are three areas within the Tule Elk Reserve where elk are likely to be located: Tomales Point Trail to White Gulch, parking lot to McClures Beach, and along the road above the parking lot. All of these are marked on the map included in the "Attachment" section of Teacher's Preparation.

   Prepare to be flexible about locations where you might observe tule elk. Elk are free to roam within the 2,600 acre reserve.

2. **Construct Field Journals**

   Distribute photocopies of Field Journal sheets for students to assemble. Refer to **Tips for Constructing Field Journals** following this lesson.

3. **Review Field Activities**

   Once journals are completed, review field activities by having students turn to the appropriate pages in their journals as you review expectations listed below. Students may also record their names at the bottom of each journal sheet (in the event that sheets become separated from the journal).

• Things to Remember While on Field Trip
This sheet will be used in the next lesson Safety and Stewardship Challenge.

• Habitat Survey at Trailhead
Students will fill in the appropriate information based on their observations. The air temperature and wind speed can be estimated, or students can use the thermometer and anemometer available in the Tule Elk Kit. Students can describe the location in terms of what they see, smell, hear, etc.

• Elk Population Survey
Once students find a group of elk to survey, students will record the numbers of each type of elk they see (bulls, cows, calves). Students will also record information on radio collars and "signs" of elk such as scat or footprints.

Review with students the difference between male, female, and calf elk. For the purposes of this activity, students should assume any elk without antlers are females (most classes will visit during the season that males have antlers).

• Field Guide to Elk Behaviors
Students will use this sheet to list the types of behaviors they are observing on the following sheet titled "Elk Behavior Survey."

• Elk Behavior Survey
Students will record the behaviors they observe and indicate whether it was a bull, cow, or calf performing the behavior.

• Mapping
Students will map the elk they observe in a "bird's-eye" view. Students may choose to use the line drawn map or the topographical map. The Topographical Map is more accurate, but the Line Drawn Map may be more appropriate for younger students. The blank map is used for any area other than White Gulch where students may want to map a tule elk herd.

• Habitat Survey on Tomales Point Trail
Students will have a chance to sit down somewhere near the Tomales Pont Trail to answer the questions on this sheet.

• Exclosure
If the class walks by an exclosure close to the trail, this sheet can be used to focus their observations. An exclosure will look like a high wooden fence forming a square over a section of land.

• Human Influences on Tomales Point

Students will have a chance to sit down somewhere near the Tomales Point Trail or trailhead to answer the questions on this sheet.

4. Field Trip Preparation

Review what students should bring on their field trip.

Extension Ideas

1. Practice identifying elk behaviors in class. Show students the images of elk behaviors (in the journal) without the descriptions and have them guess which behavior is being depicted. This is excellent practice for the **Elk Behavior Survey** field journal sheet.

2. Practice the Mapping activity in class. Have half of the students spread out in an open area and have the other half of the class "map" the surrounding area and where individuals are located. This is excellent practice for the **Mapping** field journal sheet. Remember to have students identify males, females, and behaviors.

3. Research the laws written to protect mammals, plants, and amphibians in Point Reyes National Seashore, California, and the United States. What happens if a protected animal leaves the area affording protection?

4. Research the role of a wildlife biologist and other types of careers in wildlife management. What is done with information collected in the field, and how does it help the organism being studied?

Tips for Creating Field Journals

Materials

- ☐ Field Journal sheets for each student, teacher, and chaperone
- ☐ One package blank paper and one package lined paper
- ☐ Colored paper, cardstock, or cardboard for journal covers
- ☐ Magic markers or colored pencils for decorating covers
- ☐ 3-hole punch
- ☐ String, binding tape, or twigs and rubber bands for binding
- ☐ Pencil on a string for each student
- ☐ Two plastic pencil sharpeners and extra pencils for field trip
- ☐ One box of large ziplock bags to rainproof journals

Procedures

1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or a twig bound by rubber bands threaded through holes.
5. Once journals are bound, have students decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have each student use a magic marker to write their name on the front cover of their journal.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension Ideas

1. Create a journal that is used throughout the year.

2. Share student journals with parents at open houses.

3. Students may choose to use their journals to create a class newsletter, resource newspaper, or class website.

Safety and Stewardship Challenge

Students will learn methods for observing tule elk and understand proper behaviors in a National Park. This will be accomplished by simulating a group "game show" and completing the first page of their field journals.

Time required: 1 hour

Location: classroom

Suggested group size: any

Subject: science

Concepts covered: low impact use of natural areas, behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service

Last updated: 06/20/00

Student Outcomes

At the end of this activity, the students will be able to:

- List three safety precautions for upcoming field trip.
- List three proper behaviors for viewing tule elk.
- Understand concepts of National Park System and stewardship.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard F - Personal Health: Injury Prevention; Populations, resources, and environment.

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team has the first answer)

To be photocopied from this guide:

- **Safety and Stewardship Challenge Questions** Teacher Information Sheet (one set)

Vocabulary

stewardship

Pre-Visit Lesson Plan

Procedures

1. Divide class into teams.

Option A: If your class works well in large groups, divide the class into two teams. Each team will need a spokesperson and team name. Answers will come from the entire group. Spokesperson can change throughout the game.

Option B: If your class may get too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Randomly choose a number from a hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.

2. Draw Challenge Grid and Scorecard on Blackboard.

There are four categories with questions of varying value. As a finale, there is a final challenge question. Draw this grid on the chalkboard:

<table>
<tr><td colspan="4">Safety and Stewardship Challenge</td></tr>
<tr><td>Category #1
Take Care of Yourself</td><td>Category #2
Minimize Your Impact</td><td>Category #3
Tule Elk Etiquette</td><td>Category #4
The National Park Service</td></tr>
<tr><td>1 point</td><td>1 point</td><td>1 point</td><td>1 point</td></tr>
<tr><td>2 points</td><td rowspan="2">2 points</td><td>2 points</td><td rowspan="2">2 points</td></tr>
<tr><td>3 points</td><td>3 points</td></tr>
<tr><td rowspan="2">4 points</td><td rowspan="2">3 points</td><td>4 points</td><td rowspan="2">3 points</td></tr>
<tr><td>5 points</td></tr>
<tr><td colspan="4">Final Challenge</td></tr>
</table>

3. Choose Game Show Hosts

Option A: Teacher is responsible for asking all of the questions.

Option B: Four students will become "Challenge Hosts." Each student receives questions for a specific category and will ask appropriate questions according to point value.

4. Rules of the Game

- A coin flip will determine which team goes first.
- The game will end when a predetermined time runs out or when all questions have been answered.
- Team will decide which category and value of question will be asked.
- Spokespersons or individuals will poise themselves on either side of the desk bell with one hand behind their back.
- After the question is asked, the first team ready to answer will ring the bell and respond. If they are correct, the team receives the full point value.
- If they are incorrect, the other team gets a chance. If they also get it wrong, the first team can try again for one less point.
- When brainstorming answers, students should whisper so the other team doesn't eavesdrop.
- When all of the categories are complete (or 5 minutes before a predetermined "game-over" time), class will go into "Final Challenge." Each team decides on the amount of their wager, listens to the question, and writes down their answer on a sheet of paper. Each team reveals their answer.
- At the end of the game, the team with the most points "wins," but everyone wins if your visit to Point Reyes National Seashore is safe for you and the resources.

5. Complete first page of field journal.

Using the information gained in this game show, have students list at least three items under each category on the first page of their journal (**Things to Remember While on Field Trip**). Use the **Safety Issues: Tule Elk** Teacher Information Sheet at the end of this lesson as a guide.

Safety and Stewardship Challenge Questions

Teacher Information

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because...

A you will not be able to speak well with a dry throat.

B not drinking enough water can give you a headache and cause you to make bad decisions.

C a heavy water bottle will slow you down as you are walking.

D All of the above

2 points

If the sun feels warm, you should...

A try to get a tan.

B use sunglasses, sunscreen, and/or a hat.

C take off your shoes and walk barefoot.

D All of the above

3 points

Cliff edges at Point Reyes National Seashore are...

A made of granite and safe as long as you have one foot flat on the ground at all times.

B sandy, loose, and slipper;, be careful at all times.

C safe if you have good balance.

D the best places for a good view.

4 points

The best way to dress for a field trip:

A comfortable, close-toed shoes.

B a t-shirt and a heavy, waterproof jacket.

C "like an onion,"-many thin layers with a waterproof one on the outside.

D A and C

Safety and Stewardship Challenge Questions

Teacher Information

CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because...

A you are more likely to pick up a tick in grassy areas.
B when you travel off-trail you can damage plants.
C you are causing erosion.
D all of the above

2 points

It's okay to take home just one rock from Point Reyes National Seashore.

A Sure, it's just one, but let your teacher know.
B No, every rock is home to many bugs and plants.
C No, with 2.5 million visitors, the Seashore would be rock-less if every visitor collected just one.
D B and C

3 points

Trash is....

A okay to hide behind bushes in a National Park because it will eventually break down.
B not a good source of food for hungry animals.
C not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's yours, or trash that someone else accidentally left behind.
D only the responsibility of the maintenance staff, wherever it is.

Safety and Stewardship Challenge Questions

CATEGORY #3: Tule Elk Etiquette

1 point

If a tule elk is close, you should...

A feed it some of your lunch.

B leave it alone; if the elk becomes alert or nervous you are too close.

C make alpha bull noises so it will look your way.

D yell really loud to your entire group so everyone sees it, even if it may scare the elk away.

2 points

The best way to observe tule elk is to:

A watch quietly.

B whisper.

C move slowly.

D all of the above

3 points

Tule elk were nearly driven to extinction because of:

A hunting.

B conversion of tule elk habitat into agricultural land.

C disease.

D all of the above

E A & B

4 points

When is it appropriate to approach a tule elk?

A When there are a cow and a calf ONLY.

B When there are a bull and a group of cows.

C When two bulls are challenging each other.

D You should NEVER approach a tule elk.

5 points

If you see a tule elk antler, you should...

A take it home as a souvenir.

B return it to the closest elk missing an antler.

C leave the antler just where you found it. Rodents and other wild species will chew it and use it as a source of calcium.

D report the antler to a ranger immediately-a loss of antlers is a sign that the tule elk are sick.

Teacher Information

Safety and Stewardship Challenge Questions

CATEGORY #4: The National Park Service

1 point

Which of the following is not in the National Park Service?

A Grand Canyon National Park, AZ
B Keweenaw National Historical Park, MI
C Monterey Bay Aquarium, CA
D Golden Gate National Recreation Area, CA
E Yosemite National Park, CA

2 points

I should treat Point Reyes National Seashore with respect because...

A ...it belongs to everyone in the entire United States.
B ...it preserves a part of the ecosystem you live in and depend on.
C ...it's one of the few places natural processes can happen with little intervention from human beings.
D All of the above

3 points

Which of the following is the mission of the National Park Service?

A. Preserve natural and cultural resources.
B. Provide for the enjoyment, education, and inspiration of this generation.
C. To care for special places saved by the American people so that all may experience our heritage.
D. Cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.
E. All of the above

Bonus for one additional point:

Is the Mission of the National Park Service a law? **Yes**/No
Yes. The 1916 Organic Act mandates the National Park Service to preserve and protect the natural and cultural heritage of the United States for the enjoyment of its citizens, leaving them unimpaired for the enjoyment of future generations.

FINAL CHALLENGE

This question is worth the amount that each team agrees to wager.

What does Stewardship mean?

Teacher is the final judge on this answer.

Safety Issues: Tule Elk

Personal Safety

- Watch where you are walking; the ground may be rocky and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays; use sunscreen and/or a hat.
- Stay on paths and in picnic area. Grassy areas may have ticks known to transmit Lyme Disease.
- Be aware of students' and chaperones' allergies and conditions that may cause concern on the trail.
- Bring warm clothes with you on the trail at Tomales Point. The weather may be warm at the beginning of a hike and then quickly turn cold and windy or vice-versa.

Elk Watching Tips

- Always observe elk from a safe distance. Use binoculars and spotting scopes to get a good view.
- Speak in whispers.
- Never come between two elk!
- Stay far away from bulls during rutting season.
- If you are near elk and they appear nervous or begin to move away, you may be too close. Slowly back up.

Remember... You are in a part of the National Park System

- Point Reyes National Seashore is a natural area set aside by Congress and concerned citizens to protect living and nonliving components of an ecosystem. Treat everything with respect.
- Allow plants, rocks and everything to continue their existence as part of an ecosystem by leaving all things as they are found.
- Stay on established trails and pack out trash or use garbage cans.

How Do I Use Binoculars?

Students prepare for upcoming tule elk field trip by becoming familiar with binocular structure and use. The ability to use binoculars will be crucial for observing tule elk behaviors and other details.

Time required: varies

Location: in class and/or sections at Bear Valley Visitor Center

Suggested group size: entire class

Subject: physics

Concepts covered: binocular structure and use

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 09/31/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand the structure of binoculars.
- Practice focusing on moving images with binoculars.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade	7b-appropriate tools/technology to perform tests, collect/display data
7th grade	6b-to see an object, light emitted/scattered must enter eyes
	6d-simple lenses used in optics
	7a-appropriate tools/technology to perform tests, collect/display data

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Abilities necessary to do scientific inquiry: use appropriate tools and techniques to gather, analyze, and interpret data.

Pre-Visit Lesson Plan

Materials

To be provided by the teacher:

- Tule Elk Kit and 20-40 pairs of binoculars (available for checkout at the Bear Valley Visitor Center)

Procedures

Note: This lesson can be done in various stages depending on whether or not students have access to binoculars in class.

If students can ***bring in a pair*** of binoculars to use in class--
this entire lesson can be conducted in class.

If students can ***share a pair*** of binoculars to use in class--
Procedures 1 and 2 can be taught to the entire class. Student teams can experiment with binoculars in 10-minute intervals throughout the day.

If students ***do not have access*** to binoculars--
Procedures 1 and 2 can be conducted in class, and Procedure 3 at Bear Valley Visitor Center when students receive individual binoculars from the Tule Elk Kit..

1. How do binoculars work?

In Theory: Before prisms were available, lens barrels had to be very long to increase the distance between the eyepiece lens and the objective lens to achieve magnification. These are the traditional "pirate scopes." With the introduction of prisms, the light could be bent and barrels were made shorter. Binocular vision allows two images to become one for depth perception. Monoculars are like binoculars, but made for one eye and provide no depth perception.

In Structure: There are four main components of binoculars. Power is a function of these components. A 6x30 binocular has 6x magnification and a 30-millimeter lens. A larger lens lets in more light.

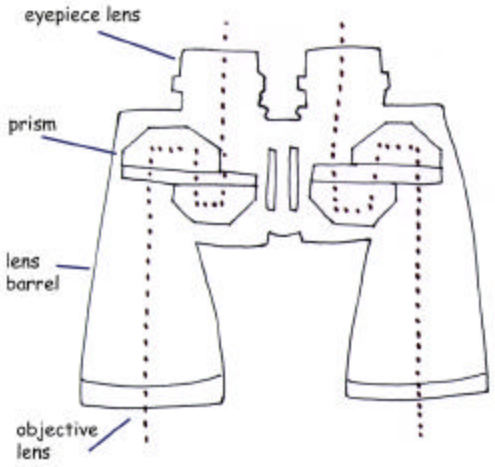
Eyepiece Lens: There are several convex lenses here for magnification. These are the lenses closest to your eyes.

Prism: Bends light rays and returns reverse image to normal.

Lens Barrel: Keeps the distance between the eyepiece lens and the objective lens consistent. Blocks side lighting and protects lenses from dirt.

Objective Lens: Gathers light in a convex lens. This is the lens that has a millimeter measurement (i.e., 6x30).

Diagram of Binocular Design



2. How do I get binoculars to work specifically for me?

Taking care of binoculars:

- Always keep them attached around your neck so they aren't accidentally dropped.
- While you are focusing binoculars, stand still. It would be easy to fall while focusing and walking simultaneously.
- Clean binoculars properly.

If you wear eyeglasses:

- Keep your eyeglasses on.
- There is usually an "eye cup" rubber piece that folds back where your eyeglasses meet the eyepiece lens.

Things you adjust once:

- Barrel distance: the two barrels can be moved closer or further apart depending on the distance between your eyes.
- Focus right eyepiece: there is a knob on the right eyepiece that corrects for visual differences between your two eyes. If you are seeing more than one image, adjust the right eyepiece until there is just one image.

Things you need to adjust with each observation:

- Center focus: Adjust the center focus with each observation to bring image into view.

Focusing on an image:

- Adjust the barrel distance and right eyepiece.
- Locate the image with your eyes. Are there any landmarks or reference points near to the image? These may help you find the image using the binoculars.
- Focus your eyes on the image. Without looking down, place the binoculars directly in front of your eyes. The rubber cup surrounding the eyepiece lens should rest against your eyebrow (unless you are wearing eyeglasses).
- Focus the image into view with the center focus.Keep your elbows tucked in close to your body, and keep both hands on the binoculars to avoid a shaky image.

3. Practice using binoculars.

Focus on a stationary object.

- Pick an object that doesn't move. Choose one that is somewhat near, and one that is somewhat far. Use the center focus.

Focus on moving objects in class.

- Right/left: have a student walk slowly across the classroom while the remaining students use their binoculars to follow in view. Speed up the student walker to add a challenge.
- Away/toward: choose a student to move toward and away from the binoculars. Discuss the range at which the binoculars will work. At some point, the student (or object) will become too close to focus.

Focus on multiple moving objects at school.

- Attend a sporting event or practice at lunch in the cafeteria.
- Place a wildlife poster on a piece of cardboard and stick. Have a student move the posterboard around the classroom: slow, fast, up, down, toward, away.

Focus on wildlife.

- Bring the class outside to an area where they are likely to view moving wildlife such as birds.